On the Discovery of a fourth Hybrid race among the Palaearctic species of the genus *Pieris*

By B. C. S. Warren, F.R.E.S.

Only three years ago I first recorded that two races, then known as forms of *P. napi*, were in reality natural hybrids. This discovery rested on the recognition of the reactions of the androconial scales to artificial cross breeding. In many experiments the development of the androconial scales was found to be disrupted; imperfect development, contortions, inverse curvature of any contour, all appearing in variable degrees of intensity and with variable frequency. I have illustrated examples of many such effects in the past (Warren, 1961, pl. 3, figs. 61-68; 1963, pl. 3; 1966, pl. 2, figs. 1-7 and 9).

Not long ago I was able to add that *meridionalis* Heyne was a third of these hybrid races (Warren 1968), and now I have established yet a fourth, which appears to belong to the Asiatic strain.

Some years ago Wojtusiak and Niesiolowski described specimens they had captured between Naltchik and Kara-su in the Caucasus in August between 1000 and 1500 m. as *P. napi* subsp. *balcarica* (W. & N. 1964). Their lengthy description is difficult to appreciate. They say the males have a resemblance to *P. rapae* with the apical markings upper side forewings short, the discoidal spot "not large". The females are quite different more as *P. napi* or *napaeae;* spots and markings "large". They go on to note that Sheljuzhko (1935), records *dubiosa* Röber from the Teberda district saying the north Caucasian form agrees well with the figure of *dubiosa* in Seitz· Later on they say that "in all probability" their specimens are identical with those from Teberda, and differ from all other forms known in the Causasus. Sheljuzhko's knowledge was the result of personal experience and he is always an accurate observer. His reference to the Sietz figure of *dubiosa* proves that some of his specimens had the triangular discoidal spot characteristic of that race in the male, and probably the apical markings also. Before dealing further with *balacarica* I must refer to Röber's description and figure of *dubiosa;* both have been ignored, yet both are very informative.

EXPLANATION OF PLATE

1, 2, 3. × *P. balcarica* W. & N. Female, Basuriani, Caucasus (Minor). August 1964. 1800 m.

4. × *P. meridionalis* Heyne. Female. Calabria. (Bred 1967.)

5. × *P. balcarica,* male. Basuriani, Caucasus (Minor). August 1964. 1800 m.

6. × *P. meridionalis,* male. Calabria. (Bred 1967).

7, 8, 9. × *P. dubiosa* Röber. Females. Vizzavona—Tattone, Corsica. July-August 1926.

10. × *P. meridionalis,* female. Calabria. (Bred 1967.)

11. × *P. dubiosa,* male. Sierre de Guadarrama, Castile.

12. × *P. dubiosa,* male. Herculesbad, Transylvanian Alps. August 1952. (Reduced discoidal spot, but typical apical markings.)

All exactly natural size and 2nd generation. Photo, E. J. M. Warren.

Röber contrasted *dubiosa* with *P. rapae* in general and the details of the black apical markings upper side forewings with *P. krueperi*, and illustrated a male with a striking, triangular discoidal spot upper side forewings. Verity was the first to follow this strange combination of characters in his work (Verity 1922). Müller commenting on Verity's paper somewhat disdainfully remarks that Röber himself had noted this already (Müller & Kautz 1939, p. 120). (All the same Müller and Kautz failed to realise that *dubiosa* existed.) Though Röber is said only to have known the males, the females actually correspond with the description just as exactly, and in them the likeness to *P. krueperi* is often very striking. It may be as well to note the resemblance lies in the apical markings, the "true transverse pattern" as distinct from the "nervural pattern" as Verity puts it (Verity 1922, p. 142). The inner end of the black marking is cut off more abruptly, while the white ground breaks into the under side of the black destroying the usual, even curvature of that edge. Even though slight, this feature catches the eye readily, when pronounced it alters the look of the apical marking to a surprising extent. The likeness is further increased by the form and size of the discoidal spots upper side forewings in both sexes, and the forewing being broader and rounder than in *P. napi*, though perhaps slightly narrower than in *P. krueperi*, which is what was implied by Röber's remark about it being "narrow". These characteristics were commented on, and also the constancy of type in this insect at Vizzavona in Corsica by Bretherton and de Worms (1963). They have long been known to collectors familiar with the insect in Spain and Corsica. Haig-Thomas writing about "var. *dubiosa*" says "the insect is also larger and the forewings are much broader than in *P. napi*" (Haig-Thomas 1929).

This likeness to *P. krueperi* is also seen in *pseudorapae* but much less markedly, the general characters of the discoidal spots will always distinguish the latter from *dubiosa*. (See details at end of this paper.)

Verity named the Asiatic race "*pseudorapae*" in 1908. At that time this action was recognised as automatically restricting the name "*dubiosa*" to the Spanish race, and *pseudorapae* has been used in this sense in all countries for the past 40 years or so, notably by those who lived in the Near East and specialised in the lepidoptera of that region (Graves 1925; Wiltshire 1957; the late R. E. Ellison sent me specimens under this name—see Warren 1961, pl. 1, fig. 22).

The name "*dubiosa*" has also been much used for the Mediterranean insect (Cooke and Straubenzee 1928; Haig-Thomas l.c.; Bretherton and de Worms, l.c.).

The first time I saw *dubiosa* in Corsica in 1926 I felt it could not be conspecific with *P. napi*, it seems that others thought likewise. I possess two notes on "*dubiosa*" by the late Capt. Hemming. He writes:—"I can add one piece of additional information; some years before the war Querci, collecting in Portugal, found *dubiosa* plentiful in the region of the Serra d'Estrella. I bought a considerable series from him. These included specimens in fresh condition taken over a long period: June; August; early October; late October. October seems to have been the period of the year when this insect was most abundant. I also have a short series taken near Oporto . . . which I associated with *dubiosa*". again Hemming writes, this time about Esper's *napaeae*·—"Esper's figure

(pl. 116, fig. 1 ♂) is very pale and with rounded forewings. I should not have been surprised if it was found to be a *dubiosa*". (Hemming in. litt. both notes bearing his signature.) His reference to the wing shape shows he was familiar with true *dubiosa*. This character was stressed again a few years ago, as already noted (Bretherton and de Worms 1963). Hemming's suggestion may be nearly correct, for *napaeae* might be a natural hybrid, *napi* × *bryoniae*. Such a hybrid form exists at low levels in some valleys of the Berner Oberland. It shows many characters of *dubiosa*. Verity noting the likeness to *bryoniae*, concluded *napaeae* to be a second generation of that species (Verity 1922). Now the question of the two localities given by Röber has been brought up again (Riley and Bowden 1969). They wish to disassociate the name "*dubiosa*" from the western race (i.e. to disregard the details of Röber's description and his figure).

Their paper is based on false premises, so make things rather confused. One useful point, however, emerges from it. They accept on the strength of breeding experiments by Bowden that *meridionalis* of Caliabria and *dubiosa* of Corsica are the same subspecies (Riley & Bowden 1969). Bowden had previously made experiments crossing Corsican *dubiosa* with *P. napi* and *P. bryoniae*. On the results of these experiments he concluded *dubiosa* was separable from both these species by "important genetic differences" which "might" be as great as those between *napi* and *bryoniae*. But he concludes *dubiosa* cannot be quite specifically distinct from these species and retains it as a subspecies of *napi* (Bowden 1966). As he now finds *dubiosa* and *meridionalis* genetically the same, we must accept that *meridionalis* differs from *napi* and *bryoniae* as *dubiosa* does. He accepts both as subspecies of *napi*, rather for want of a better definition. In his view then these races were not fully, specific entities, but yet something more than normal subspecies.

All this agrees with the evidence I have derived from the developments in the androconial scales, which has shown that *dubiosa* and *meridionalis* are both hybrids of a similar strain (i.e. the European strain, Werren 1968). Both differ in similar manner from *napi* and *bryoniae*, yet they cannot be separated from them as species, in the accepted sense of the term, or connected with them as subspecies. Bowden and I have been describing the same phenomenon from different view points, but this does not alter the meaning, or lessen the accuracy of the work. It serves, however, as a timely reminder that the results derived from the study of the androconial scales, or breeding experiments, largely correspond. Taxonomically both are equally reliable and therefore of equal value; they are corroborative; but the scale developments are more informative and definite. By breeding it is possible to establish the degree of divergence separating two individuals but it is impossible to ascertain whether either or both are of hybrid origin. This will help readers to realise that the results obtainable from breeding experiments, though important, cannot transcend anatomical facts. When Riley and Bowden say *meridionalis* and *dubiosa* have been proved by breeding experiments to be "belonging to the same subspecies"' this means that both agree genetically to a certain extent; as all subspecies of any species probably do. But this does not mean that all subspecies must be the same; that there is only one subspecies in a specie. *Dubiosa* and *meridionalis* are

doubtless, genetically alike, both being hybrids of the European strain, but physically they are very different races. Anyone looking at the plate accompanying this paper will not need to be told this. The two resemble each other about as much as *P. brassicae* and *P. napi* do. (Figs. 4, 10, female; 6, male *meridionalis* from Calabria; figs. 7, 8. 9, *dubiosa* female from Corsica; 11, male from Castile; 12, male from Herculesbad, Transylvanian Alps). There is of course variation as in all *Pieris* races, and more in *dubiosa* than *meridionalis*. But recognition of either in the 2nd generation could never cause much trouble. One need only note that *meridionalis* never develops the characteristic, apical markings, or the large, equal-sized, rounded discoidal spots on the upper side forewing such as are typical of the female *dubiosa*. In *meridionalis* the discoidal spots are rectangular and always angled, the lower one much the smaller. The male *meridionalis* is normally without a discoidal spot on the upper side, and should one appear it is never of any pronounced size, let alone of a heavy, triangular form. Further, the discoidal spots give another, less obvious, but absolutely constant character distinguishing the males of the two races. In *dubiosa* there are two well-marked spots on the under side of the forewings, the lower one of which always shows through on the upper side. (This can even be seen, faintly, in the photographs figs. 11 and 12.) Such spots are only rarely present on the under side in *meridionalis*, and the lower one never shows through on the upper side. The characteristic features of *dubiosa* were commented on by Bretherton and de Worms, who state that at Vizzavona "*dubiosa* is a very striking insect" differing markedly from ordinary *napi* (B. and de W. 1963).

To say that *dubiosa* of Corsica and *meridionalis* of Calabria are the same displays a complete indifference to the characteristic features of both races. Yet this alleged identity was made the basis for their proposed changes in nomenclature by Riley and Bowden. To accept this one has to assume, either that a well-known race that has been recorded from 5 countries and has been the subject of many detailed papers, does not exist, or that *meridionalis* implies two different things and can be used for either as occasion demands. This will strike most readers as incredible; but it is the meaning, in plain language, of the statement that "the Andalusian locality is pre-occupied by subsp. *meridionalis*" (Riley and Bowden 1969).

Starting from such a hypothesis their subsequent arguments become a chain of interdependent misconceptions; *meridionalis* does not pre-occupy the Andalusian locality; so *dubiosa* was not restricted to Asia Minor, and *pseudorapae* was not a synonym of *dubiosa* until they made it so, by citing a specimen of *pseudorapae* as type of *dubiosa*, which left the Andalusian insect without any name. Such a citation of a type is meaningless. It invalidates two familiar names, replacing them with one and fills the gap by using another familiar name as representing two different things.

There is no need to consider this matter further. Having clarified the seeming discrepancy between Bowden's research work and my own we can return to *P. balcarica*. For a long time I was unable to form any certain view about it. Then Mr Yuri Nekrutenko of Kiev sent me a small series of Caucasian specimens, 5 male and 4 female, taken at Basuriani in the Caucasus in August at 1800 m. These must be *balcarica*

and they agreed with the various descriptions I have. The discoidal spot upper side forewing in the males is variable but distinctly marked, in one it is large and square with a straight outer edge as in *P. mannii* (see fig. 5). Such a specimen would account for Sheljuzhko's reference to the figure of *dubiosa* in Seitz. The females are remarkable, suggestive of *P. napi* or *napaeae* as Wojtusiak and Niesiolowski noted, but almost more like *P. mannii*. This resemblance was also noted by Sheljuzhko (1935). The discoidal spots and apical markings upper side forewings in the females are almost square and the two spots the same size (figs. 1, 2, 3). The general appearance of the specimens also suggests *dubiosa*, but the forewings are not so broad or rounded (compare with figs. 7, 8, 9). and the insect is smaller and the apical markings denser. The race is evidently a constant one. On examining the scales I was not surprised to find *balcarica* was another branch of the hybrid strain, showing great disturbance of the scale development.

It may be useful to note that the two specimens described as *P. napi caucasica* by Verity (Rhop. Pal. 1908, p. 144, pl. 32, fig. 21, male, 22 female), is a form of *P. bryoniae*. In his later review of the *napi* and *bryoniae* races, he places his "nymotypical *caucasica* fig. 22", in his Grade II, which covers the typical, monogenerational *bryoniae* forms (Verity 1922, p. 130). Müller states Verity's fig. 22 is a *bryoniae* with a white ground colour (Müller & Kautz, 1939, p. 117), but questions if such occur in the Caucasus. Kautz, later, (l.c. p. 147), corrects this, having received specimens from Sheljuzhko, which he figures (l.c. pl. 10, figs. 9-12).

It is interesting to note Sheljuzhko's comments on the "sehr veränderliche" summer generation of what he calls *P. napi suffusa* Vty. in the Caucasus and Transcaucasus (1931). As he suggested *balcarica* was *dubiosa* it can only be supposed that his *suffusa* was *pseudorapae*. The late R. E. Ellison sent me specimens of what he called "1st generation *pseudorapae*" that had such extremely suffused markings on the under side hindwings that I always concluded "*suffusa*" was the name of the 1st generation of that race. Sheljuzhko's remarks on the very variable summer generation agree with what is known of that insect. The male can be as often without as with a discoidal spot on the upper side and these spots in the females are very variable also. I have been sent both types of male from several localities, ranging from Turkey to the Tian Shan, with the suggestion that they were distinct species; but the scales proved they were not. Apparently some collectors identify their specimens entirely by the presence or absence of the discoidal spots in the males.

Some of the mistaken views as to what "*pseudorapae*" and "*dubiosa*" stood for are probably due to the fact that Müller and Kautz failed to recognise either in their book. They did not even seem to know that any *napi*-like insect existed in Spain, much less in Corsica. The only mention they make of the Iberian Peninsula is to note that the "var. *lusitanica*" flies in Portugal, but they do not tell one anything about it, except that it appears to be a form with strikingly enlarged discoidal spots. There is still more to learn about the distribution of all these hybrid races. Kautz says that in Lombardy both *P. napi* and *meridionalis* occur, separately, or in some cases together, probably as a mixed race. (Müller & Kautz, 1939, p. 144). That the two meet in northern Italy is

more than likely, they may well interbreed; this would account for specimens such as he figures (Müller & Kautz 1939, pl. 3, figs. 8, 9). There might, however, be a possibility that *dubiosa* actually occurs in Lombardy, considering it has got as far north as the Transylvanian Alps in the Balkans, and its presence in Corsica. What exists in Sicily is still very uncertain, quite possibly both *meridionalis* and *dubiosa* or hybrid populations; even a remnant of *P. napi*.

It may be useful to note the characters that distinguish the four hybrid races; in the summer generations.

× *P. dubiosa* Röber. Slightly smaller than *meridionalis* or *pseudorapae*. Apical markings and discoidal spots upper side, and shape of forewings suggestive of *P. krueperi*. Two discoidal spots in female, large, rounded, equal sized; one in male, variable, well-marked or very large, often triangular, the point directed towards the base of the wing the outer edge flat as in *P. mannii*. Two discoidal spots under side forewings in male, the lower showing through on the upper side. Spain, Portugal, Corsica, Greece, Transylvanian Alps.

× *P. balcarica* W. & N. Smaller than the other races, resembles *dubiosa* but also *P. mannii*. Apical markings and discoidal spots upper side forewings, square and equal in size in female; often square in male but also less developed. Lower of two discoidal spots under side forewings in male shows through on upper side. Caucasus.

× *P. pseudorapae* Vty. Equal in size to *meridionalis*. Markings and spots upper side variable in both sexes. The females mostly suggestive of *P. napi* or *meridionalis;* discoidal spots larger than in *meridionalis*, the upper one square but the angles rounded off; lower one markedly smaller, rectangular. Male with or without one spot, when present very variable in size, slightly rounded. Lower of two spots under side forewings showing through on the upper side. Constantinople, Turkey, Syria, Iraq, Persia, Turkestan, Tian-Shan.

× *P. meridionalis* Heyne. Large. Markings upper side resembling *P. napi* in both sexes, sometimes *P. brassicae*. Discoidal spots upper side: male, normally without any, if present small and amorphous. In female rectangular and angled, the lower one markedly smaller. Usually without any spots under side forewings but if a trace of them is present the lower one never shows through on the upper side. Italy and south-east Europe.

Readers will note that *pseudorapae* stands rather between *dubiosa* and *meridionalis*. These four races are familiar to most collectors of Palaearctic butterfles and it will be appreciated that the names as used here were those first given to them. Some few may wish to change them and use "*dubiosa*" for "*pseudorapae*", that they can have supposed it possible to wipe out one in order to use the name elsewhere passes the bounds of credibility. That any type citation could be held to validate such an action, reflects very badly on the whole process of type citation.

Hybrid races such as these are referred to by specific names, as though true species, but the generic name has to be preceeded by the sign of multiplication.

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Macros and a few Micros in South Essex, 1968

By R. Tomlinson

Apart from a successful visit paid to the local Martinhole Woods on March 9, with Don Down for *Apocheima hispidaria* Schiff., nothing of note appeared until my next field trip on April 21. This was made to Hall Woods, Langdon Hills with my friends Derek and David Grimsell. We ran the generator with a 125 watt mercury vapour bulb from 8.40 until 11 p.m. in a sheet operation. Seventeen species of moths came to the sheet, including *Selenia tetralunaria* Hübn., *Polyploca ridens* Fab. (this species is pretty well melanic around this area), and several *Lampropteryx suffumata* Schiff. of which I kept three. Mr. Huggins has never found that *suffumata* is common in Essex. As for *ridens*, he has not seen a great number of Essex specimens in recent years, but before the war he saw several at various places, and never a dark one.

A nice *Orthosia advena* Schiff. came to the Robinson trap in the garden on the night of April 24, and a perfect *Cucullia verbasci* L. on the following night.

It was about this time that I took three specimens of what I like to call the two-spotted form of *O. gothica* L. all within ten nights. In this form the lower bar of the "character" mark is missing, leaving two dots on each wing. I captured one in 1966 and another in 1967. Tutt mentions